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ROCKWELL 7303A SERIES

Rockwell International

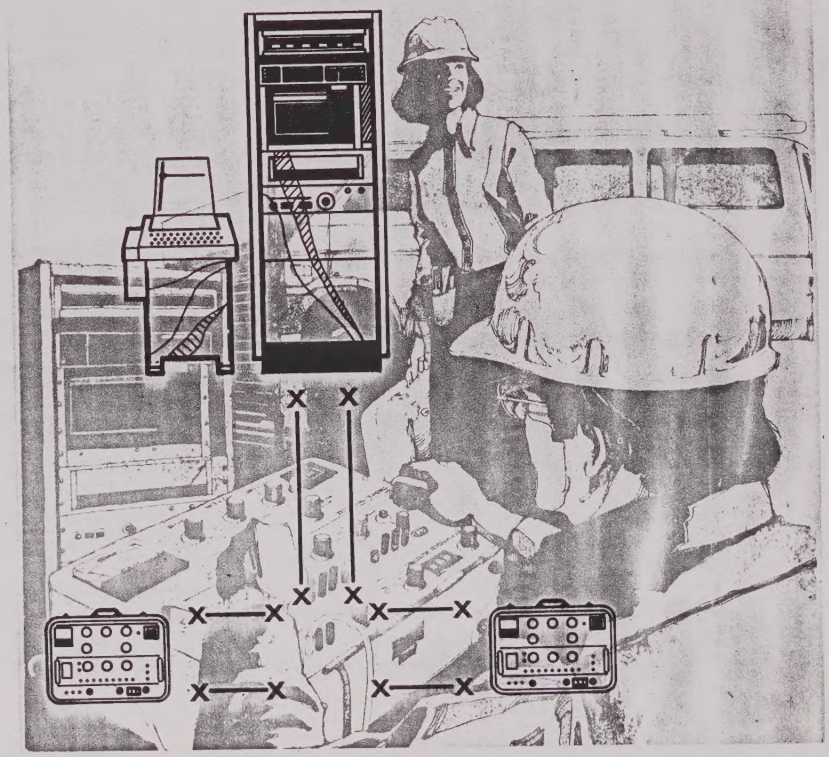
Collins Microwave Systems Division
Commercial Telecommunications Group
P.O. Box 10462
Dallas, Texas 75207

Rockwell International

Collins user's guide

Commercial Telecommunications Group

Collins TSG Test Signal Generator



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introduction

You, the craftsman, can test data and voice communication lines rapidly—and economically— with Collins TSG (Test Signal Generator). All the test equipment you need is consolidated in a rugged unit that you can carry easily to the peripheral site. With a Collins CLA (Communications Link Analyzer) at the test center on the other end, you can check out a line in minutes.

The TSG-CLA combination measures:

- Line loss
- Frequency response
- Envelope delay
- Intermodulation distortion or harmonic distortion
- Phase jitter
- Frequency offset
- Noise
- Impulse noise

The TSG-TSG combination measures:

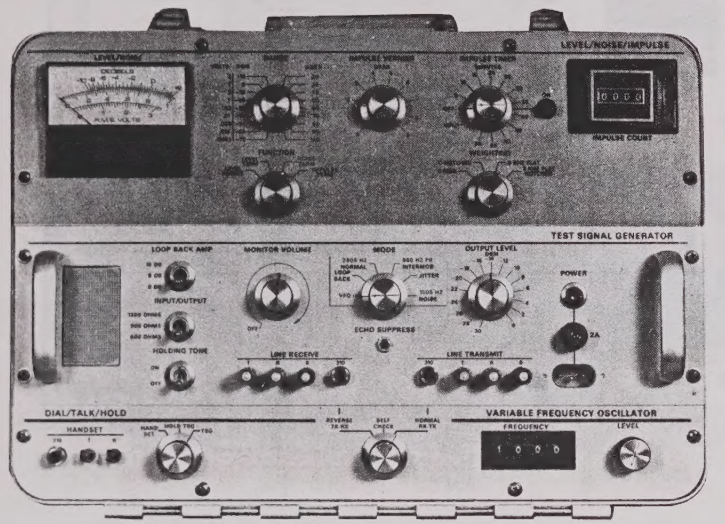
- Line loss
- Frequency response
- Noise
- Impulse noise

With 2-wire as well as 4-wire test capability, you can cover a variety of assignments—long line, private line, switched network, DDD. Everything you need for 2-wire tests is included—line-hold circuitry, line transfer switching, and provisions for connecting handsets for test coordination.

The TSG is available in several models. The following chart gives the capability of each model.

MODEL	P/N 622-	TSG	VFO	TSG + INTERMOD	2-WIRE + VFO
7303A-1C	0821-022	X			
7303A-4D	2225-001	X	X		
7303A-5C	1155-001		X	X	
7303A-6C	1156-001			X	X
7303A-9C	2414-001	X			X
7303A-10C	2435-001			X	

controls and indicators in the LNI assembly



LEVEL/NOISE
meter ..... A dc milliammeter scaled in rms volts and decibels provides display of signal level or circuit noise of the receive transmission line. Selection of display is made by RANGE and FUNCTION switches.

RANGE switch ..... A 9-position rotary switch provides selection of input signals from +10 to -80 dB mW in signal level measurement and from 10 to 100 dB rn in noise measurement. Range scale for level measurement contains black numbers from +10 to -70 dB mW in 10-dB steps and from 3 to 0.0003 in a 3 and 1 alternating sequence. Range scale for noise measurement contains red numbers from 20 to 100 dB rn in 10-dB steps.

FUNCTION switch ..... A 4-position rotary switch provides selection of signal level, circuit noise, or impulse noise measurement. All three are measured using a selectable terminating impedance. Signal level can also be measured with a bridging impedance.

IMPULSE VERNIER
switch ..... A 10-position rotary switch selects the threshold level for the impulse noise counter circuits. Zero to 9 dB rn in 1-dB steps is available.

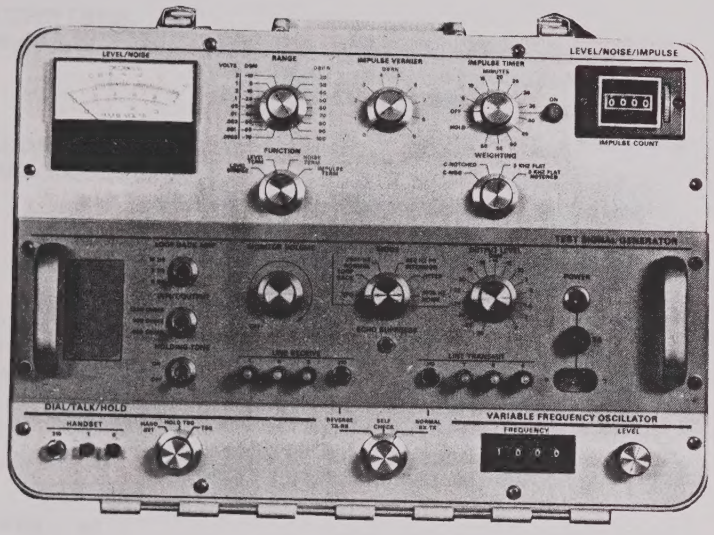
WEIGHTING
switch ..... A 4-position rotary switch provides C-message, C-message notched, 3-kHz flat, or 3-kHz flat notched filtering for circuit noise and impulse noise measurements.

IMPULSE TIMER
switch ..... An spdt rotary switch with a hold feature provides selection of an impulse noise test period from 0 to 60 minutes. The HOLD position selects an indefinite test period.

ON (timer)
indicator ..... The indicator lights during timer operation and extinguishes at the end of the selected test period.

IMPULSE COUNT
indicator ..... A 4-digit counter displays number of noise impulses counted above the selected threshold during the test period. The thumb wheel at the right provides a manual reset to 0000.

controls and indicators in the TSG assembly



Monitor speaker .....The speaker provides audio output of 1 W maximum for monitor of the receive line.

LOOP BACK AMP switch .....A 3-position toggle switch selects gain of the loop back amplifier. Amplifier gains of 0, 8, and 16 dB can be selected. Maximum amplifier outpu equals 0 dB mW.

INPUT/OUTPUT switch .....A 3-position toggle switch provides impedance selection of 600, 900, or 1200 ohms.

HOLDING TONE ON-OFF switch .....An on-off toggle switch selects a holding tone for a loaded channel noise measurement. The holding tone suppresses compandor action (bandwidth reduction) associated with weak signals.

MONITOR VOLUME control .....Potentiometer adjusts speaker output to the desired listening level.

Note

Accurate level/noise/impulse measurements require the MONITOR VOLUME to be in the OFF position.

MODE switch .....A 6-position rotary switch provides operating mode selection of the test signal generator. Mode selection includes:

VFO - (REMOTE on earlier models) - This position allows operation of the variable frequency oscillator.

LOOP BACK - The receive line is connected to the transmit line through isolation transformers and the variable gain amplifier.

NORMAL - A composite signal of equal tone pairs from 250 to 3500 Hz plus a sine wave of 1626 Hz is available at the LINE TRANSMIT terminals.

HARMONIC - A 750-Hz tone plus the reference tone of 1626 Hz is available at the LINE TRANSMIT terminals (7303A-1C, -4D, -9C only).

or:

INTERMOD - A composite signal of equal tone pairs at 860 and 1380 Hz is available at the LINE TRANSMIT terminals (7303A-5C, -6C, and -10C).

JITTER - A single tone of 1020 Hz is available at the LINE TRANSMIT terminals. Optional frequency of 1626 Hz is available by strapping.

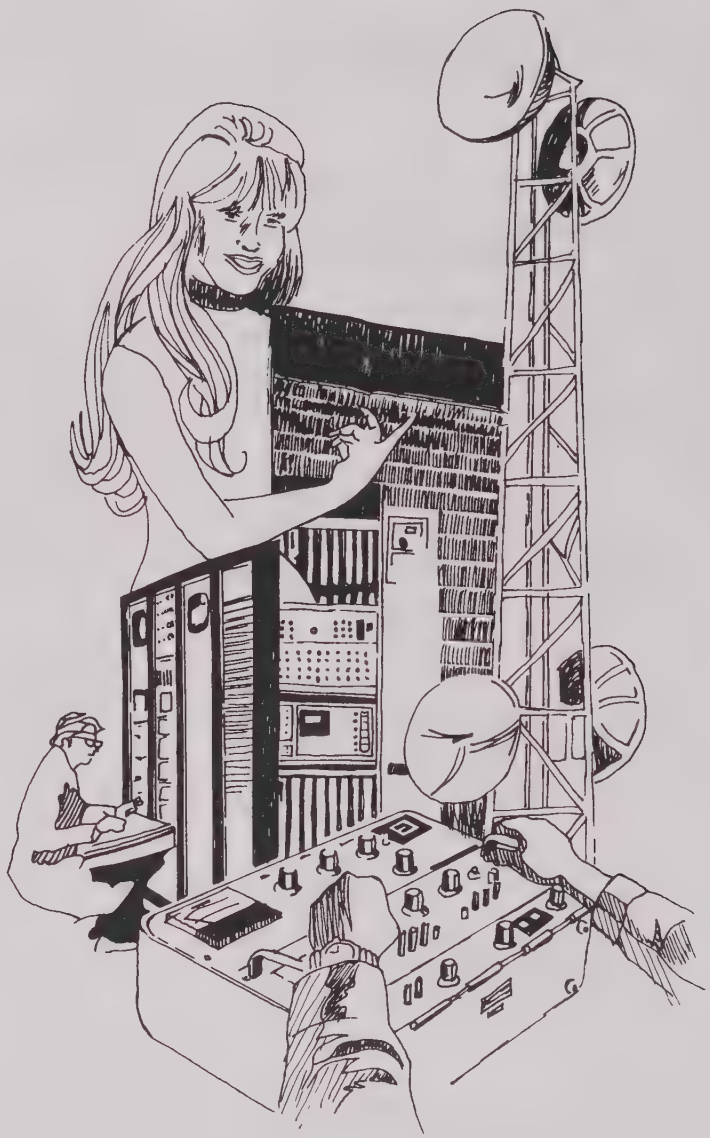
NOISE - This position provides a terminated transmit line for measuring noise at the far end of the line. The holding tone sequence may be initiated in this mode only.

OUTPUT LEVEL switch ..... A 16-position rotary switch provides adjustment of the test signal generator output level from 0 to -30 dB mW in 2-dB mW steps.

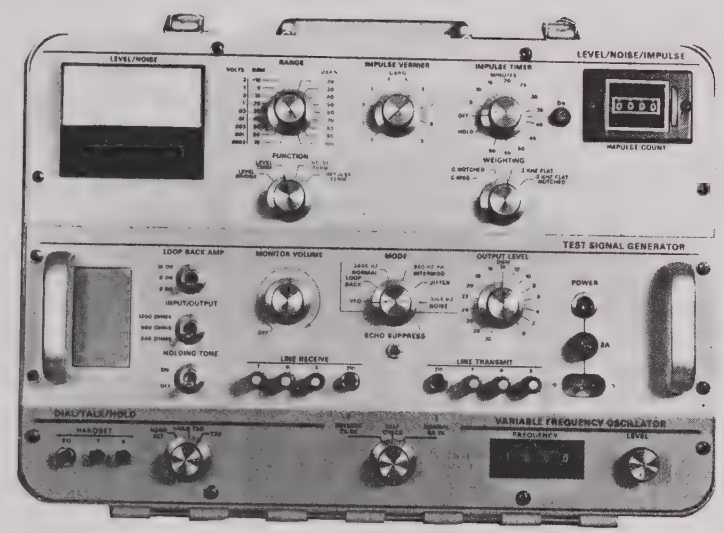
ECHO SUPPRESS pushbutton ..... A momentary pushbutton provides initiation of an echo suppressor lockout tone at 2125 Hz. The tone disables any echo suppression circuit within the communication link being measured. The echo suppression may be used in all modes.

LINE RECEIVE and LINE TRANSMIT posts and jacks ..... The posts and jacks provide connection to the input and output isolation transformers. Binding posts are available for T (tip), R (ring), and S (sleeve). Standard 1/4-in telephone jacks are provided also.

POWER on-off switch and indicator ..... Pushbutton/indicator applies 115 V ac to the power transformer when actuated to the on position. An indicator lights to show power is applied.



controls and indicators in the VFO assembly



HANDSET posts and jack ..... Standard 1/4-in telephone jack for connection of a handset. On units with serial number 9 or greater, binding posts are also available for T (tip) and R (ring).

HANDSET switch ..... A 3-position rotary switch provides mode selection:

HAND SET - Allows 2-way communication via the HANDSET posts. (Refer to note.)

HOLD TSG - Places holding coil across the test signal generator output.

TSG - The test signal generator output is applied directly to the LINE TRANSMIT output posts.

Note

For 7303A-4D and -5C, the HAND SET position of the HANDSET switch provides a self-check feature — the test signal generator circuits are connected to the level/noise/impulse circuits.

Line transfer switch for 2-way tests ..... NORMAL RX-TX - This is the normal position of the LINE TRANSMIT/LINE RECEIVE terminals. The signal generator circuit is connected to the transmit line, and the measurement circuit is connected to the receive line.

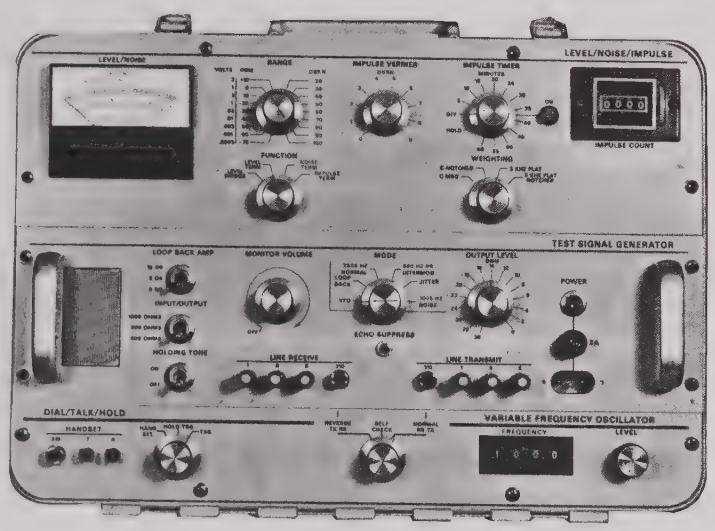
SELF CHECK - The test signal generator circuits are connected to the level/noise/impulse circuits.

REVERSE TX-RX - This is the reverse position of the LINE TRANSMIT/LINE RECEIVE terminals. The signal generator circuit is connected to the receive line, and the measurement circuit is connected to the transmit line.

FREQUENCY selection indicator ..... Thumb wheel switches (4-digit) allow frequency selection from 200 to 3990 Hz in 10-Hz increments.

LEVEL control ..... Potentiometer adjusts vfo output level.

typical operation



operating the test signal generator assembly

1. Remove the cover from the case. Remove the ac power cord from the inner storage compartment of the cover.
2. Use the ac power cord and connect the unit to a 115-V ac 60-Hz power source.
3. Press POWER pushbutton and observe that indicator lights.
4. Make connections to LINE RECEIVE and LINE TRANSMIT terminals as necessary for either one-way or looped measurements.
5. Set MODE switch to desired mode of operation.
6. Select terminating impedance for the communication link under test using INPUT/OUTPUT switch.
7. If looped measurement is being made, select gain of loop-back amplifier using LOOP BACK AMP switch.
8. Adjust MONITOR VOLUME to provide the desired listening level.
9. Adjust OUTPUT LEVEL to the test level required for the communication link.
10. As necessary, select the two special tones. Press ECHO SUPPRESS pushbutton to generate a 400- to 500-ms echo suppressor lockout tone (available in all modes). Set HOLDING TONE to ON and MODE switch to NOISE to generate the holding tone.

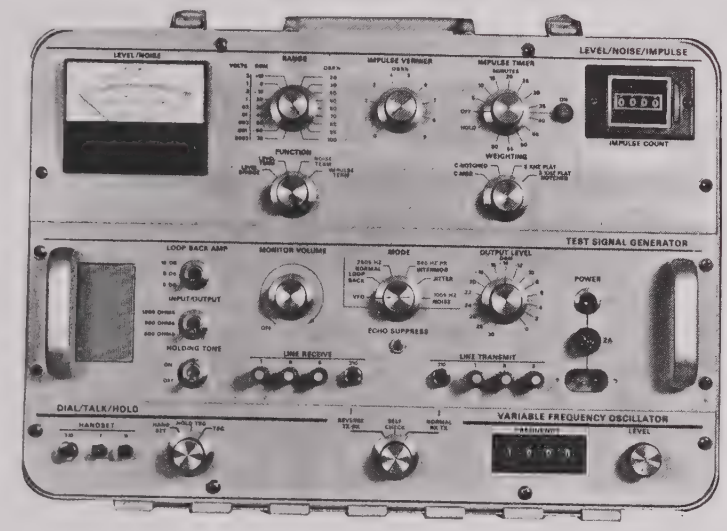
operating the variable frequency oscillator

1. Set MODE switch to VFO.
2. Adjust FREQUENCY thumb wheels to desired frequency (200 to 3990 Hz).
3. Set HANDSET switch to TSG.
4. Set line transfer switch to SELF CHECK (7303A-6C and -9C). Set HANDSET switch to HAND SET (7303A-4D and -5C). On units without the self-check feature, connect LINE TRANSMIT to LINE RECEIVE terminals.
5. Adjust OUTPUT LEVEL switch for the desired output level.
6. Set line transfer switch to NORMAL RX-TX (7303A-6C and -9C). Set HANDSET switch to TSG (7303A-4D and -5C). Remove LINE TRANSMIT/LINE RECEIVE patch of step 4.

operating the level/noise/impulse assembly

Note

MONITOR VOLUME must be in the OFF position to obtain accurate measurement using the LNI assembly. At the higher audio input levels, the high gain circuits used in metering are affected by the MONITOR VOLUME. Meter accuracy is maintained by ensuring that the MONITOR VOLUME is set to OFF during the measurement observation.



To make level measurement:

1. Set RANGE switch to highest scale of +10 dB mW or 3 V.
2. Connect line to be monitored to LINE RECEIVE terminals.
3. Set FUNCTION switch to LEVEL BRIDGE or LEVEL TERM.

Note

If LEVEL BRIDGE is selected, the meter will indicate 5.7 dB high when the line being monitored is not loaded.

4. Adjust RANGE switch to provide an on-scale LEVEL/NOISE meter indication.

To make noise measurement:

1. Connect line to be tested to LINE RECEIVE terminals.
2. Set FUNCTION switch to NOISE TERM.
3. Select desired weighting using WEIGHTING switch.
4. Measure the circuit noise by adjusting the RANGE switch to an on-scale LEVEL/NOISE meter indication.

To make impulse measurement:

1. Connect line to be tested to LINE RECEIVE terminals.
2. Set FUNCTION switch to IMPULSE TERM.
3. Select desired weighting using WEIGHTING switch.
4. Set desired threshold level using RANGE switch and IMPULSE VERNIER switch.
5. Zero the IMPULSE COUNT using the thumb wheel at the right side of the counter.
6. Set IMPULSE TIMER to desired number of minutes. The ON lamp is lit during the counting period and extinguishes at the end of the test period.

Note

The impulse counter is relay driven and impulse count cannot be recorded unless the timer is operating.

performing the self-check feature

The following procedure provides a means for self-checking the TSG 7303A-( ) by cross-checking its generated signals against its monitoring capability. This self-check establishes a level of confidence in the operational condition of the unit. Self-check tests the test signal generator assembly and the level/noise/impulse assembly. Self-check does not test the loop-back feature nor can self-check be performed in equipment models that do not include the level/noise/impulse assembly. Self-check includes the following:

Test signal generator output level check.
Test signal generator spectra functional check.
LEVEL/NOISE meter check.
Level/noise/impulse filter response check.
Impulse noise check.

To perform test signal generator output level check:

1. Set line transfer switch to SELF CHECK (7303A-6C and -9C). Set HANDSET switch to HAND SET (7303A-4D and -5C). On units without self-check, connect LINE TRANSMIT to LINE RECEIVE terminals.

2. Set OUTPUT LEVEL to 0 DBM.

3. Set FUNCTION switch to LEVEL TERM.

4. Set RANGE switch to 0 DBM.

5. Set INPUT/OUTPUT to 600 OHMS.

6. Set MODE switch to each of the following positions, and observe the indication on the LEVEL/NOISE meter.

MODE POSITION	METER INDICATION
2805 HZ (HOLDING TONE ON)	-0.2 dB mW ±0.5 dB
NORMAL (HOLDING TONE OFF)	0.0 dB mW ±0.25 dB
860 HZ PR (HOLDING TONE ON)	-0.4 dB mW ±0.5 dB
INTERMOD (HOLDING TONE OFF)	-0.3 dB mW ±0.5 dB
HARMONIC (7303A-1C, -4D, AND -9C)	0.0 dB mW ±0.25 dB
JITTER	0.0 dB mW ±0.25 dB
1005 HZ (HOLDING TONE ON)	0.0 dB mW ±0.5 dB
NOISE (HOLDING TONE OFF)	-70 dB mW max

To perform test signal generator spectra functional check:

1. Perform steps 1 through 4 of the test signal generator output level check.

2. Set MODE switch to each of the following positions and listen to each tone frequency and relative indication:

MODE POSITION	INDICATION
VFO	Output at each VFO frequency setting from 200 to 3990 Hz
NORMAL	Tone pairs and 1626 Hz
860 HZ PR (HOLDING TONE ON)	860-Hz tone pairs
INTERMOD	860- and 1380-Hz tone pairs
HARMONIC (7303A-1C, -4D, and -9C)	750 and 1626 Hz
JITTER	1020 Hz (1626 Hz optional)
NOISE (HOLDING TONE ON)	1005 or 2805 Hz

3. Repeat step 2 and initiate the echo suppressor lockout tone in each mode. A 2125-Hz signal should be heard for approximately 1/2 second with each initiation.

To perform LEVEL/NOISE meter check:

1. Perform step 1 of the test signal generator output level check.
2. Set MODE switch to NORMAL.
3. Set OUTPUT LEVEL to 0 DBM.
4. Set RANGE switch to +10 DBM.
5. Set FUNCTION switch to LEVEL BRIDGE and observe indication on LEVEL/NOISE meter. Meter reading should be approximately +5.7 dB mW ±0.5 dB.
6. Set FUNCTION switch to LEVEL TERM.
7. Vary the test signal generator output level and observe the meter. Use OUTPUT LEVEL and RANGE controls to keep an on-scale indication. The LEVEL/NOISE meter should track within ±0.2 dB on upper half of DECIBELS scale(>-4) and within ±0.3 dB on lower half of DECIBELS scale (<-4).

To perform level/noise/impulse filter response check:

1. Perform steps 1 and 3 of the LEVEL/NOISE meter check.
2. Set WEIGHTING to C-MSG.
3. Set RANGE to 0 DBM.
4. Set FUNCTION to NOISE TERM.
5. Set MODE switch to each of the following positions and observe the indication on the LEVEL/NOISE meter:

MODE POSITION	METER INDICATION
2805 HZ (HOLDING TONE ON)	-2.4 dB mW ±1 dB
NORMAL (HOLDING TONE OFF)	-1.9 dB mW ±1 dB
860 HZ PR (HOLDING TONE ON)	-1.0 dB mW ±1 dB
INTERMOD (HOLDING TONE OFF)	-0.5 dB mW ±1 dB
HARMONIC (7303A-1C, -4D, and -9C)	-1.5 dB mW ±1 dB
JITTER	0.0 dB mW ±1 dB
1005 HZ (HOLDING TONE ON)	0.0 dB mW ±1 dB

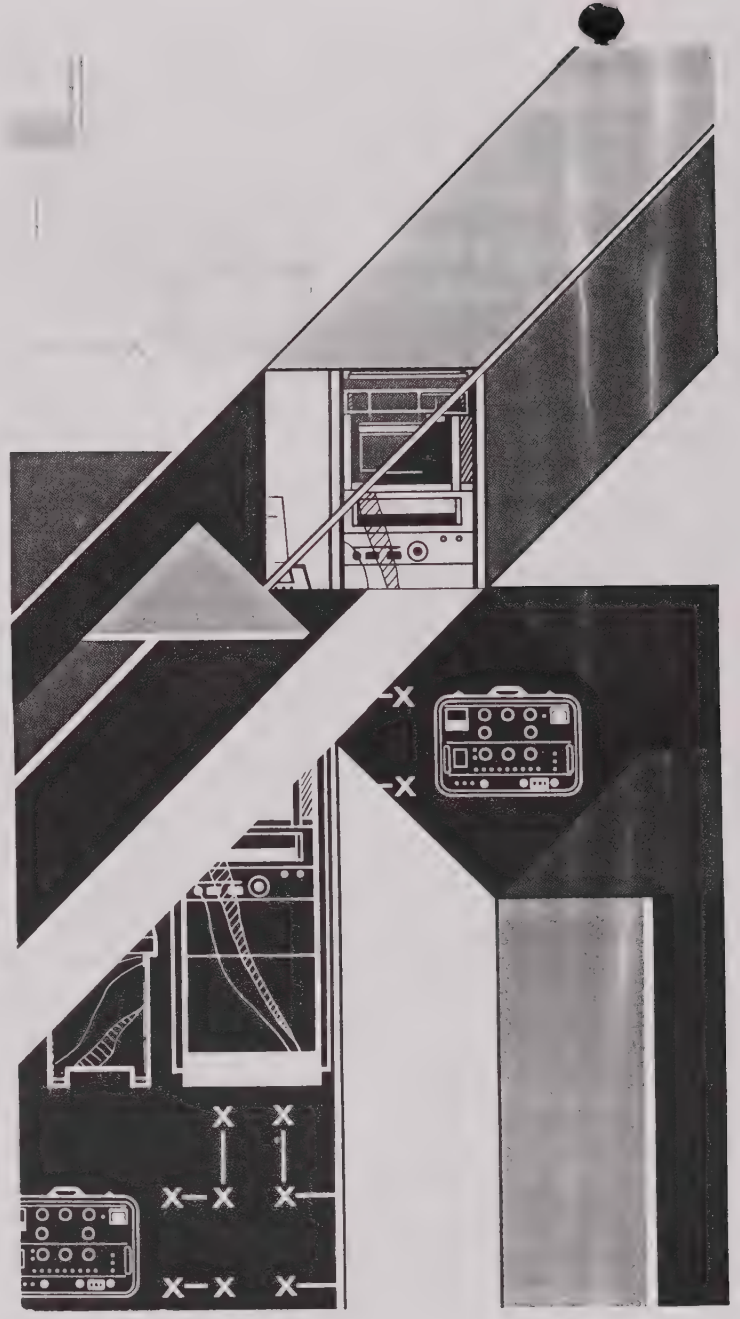
6. Set WEIGHTING to 3 KHZ FLAT.
7. Set MODE switch to each of the following positions and observe the indication on the LEVEL/NOISE meter:

MODE POSITION	METER INDICATION
2805 HZ (HOLDING TONE ON)	-3.0 dB mW ±1 dB
NORMAL (HOLDING TONE OFF)	-1.0 dB mW ±1 dB
860 HZ PR (HOLDING TONE ON)	-0.5 dB mW ±1 dB
INTERMOD (HOLDING TONE OFF)	-0.5 dB mW ±1 dB
HARMONIC (7303A-1C, -4D, and -9C)	-0.1 dB mW ±1 dB
JITTER	0.0 dB mW ±1 dB
1005 HZ (HOLDING TONE ON)	0.0 dB mW ±1 dB

8. Set WEIGHTING to C-NOTCHED.
9. Set FUNCTION switch to LEVEL TERM. Set MODE switch to NOISE. Set HOLDING TONE to ON, and observe that LEVEL/NOISE meter indicates -0.2 dB mW ±0.5 dB (0.0 dB mW ±0.25 dB for 7303A-1C). Set FUNCTION switch to NOISE TERM and observe that LEVEL/NOISE meter indicates at least -50 dB mW.
10. Set WEIGHTING to 3 KHZ NOTCHED and repeat step 9.

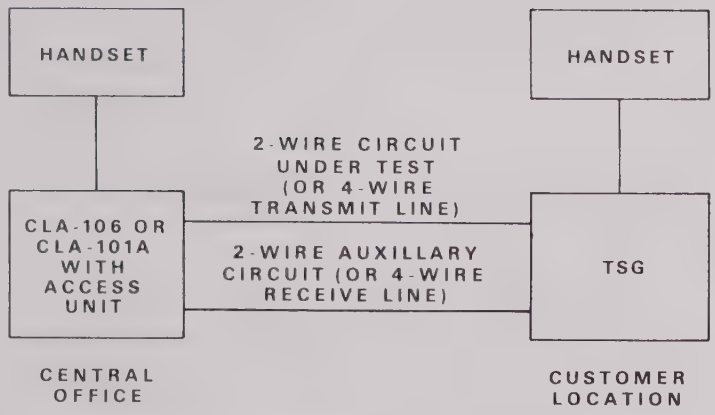
To perform impulse noise check:

1. Perform steps 1 and 3 of the LEVEL/NOISE meter check.
2. Set MODE to JITTER.
3. Set RANGE to 90 DBRN.
4. Set FUNCTION to NOISE TERM.
5. Observe which WEIGHTING setting gives the lowest response and note the value.
6. Set WEIGHTING to lowest response.
7. Set FUNCTION to IMPULSE TERM.
8. Set IMPULSE VERNIER to a minimum of 4 DBRN above reading of step 5.
9. Set IMPULSE TIMER to 5 MINUTES. Impulses should not register on the counter.
10. Set IMPULSE VERNIER to 2 DBRN less and impulses should register.
11. Set WEIGHTING to each of the other positions and verify that impulses will register. Set IMPULSE VERNIER to 3 DBRN greater than setting of step 10. Impulses should not register in all weighting positions.
12. Set IMPULSE TIMER to OFF.



how to make communication link measurements

CLA-TSG tests



The CLA-TSG combination measures:

- Line loss, frequency response, and envelope delay
- Intermodulation distortion (or harmonic distortion)
- Phase jitter and frequency offset
- Noise

Two-Wire Circuits

The CLA test signal is transmitted to the TSG over the 2-wire circuit to be tested and then looped back via an auxiliary circuit. Then a test signal from the TSG is transmitted over the auxiliary circuit to the CLA. Parameter values from the latter test are subtracted from those obtained in the loop-back test to derive CLA-to-TSG transmit characteristics on the test circuit. The TSG test signal is again transmitted to the CLA, this time on the test circuit. This enables measurement of the return characteristics.

Four-Wire Circuits

In 4-wire systems, loop-back and subtraction techniques are used to obtain transmit and receive line characteristics. The CLA can measure at intermediate points also by means of access trunks.

The following procedures provide detailed instructions for testing 2-wire circuits. When testing 4-wire circuits, the line transfer switch must remain in the NORMAL RX-TX position.

PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION
1. Set up CLA to make all tests required on circuit. If you are remote from the CLA, have your transparent line connected and the parameters of the line entered into storage.	1. Initial setup of TSG: a. Press POWER switch to on. b. Set MODE switch to LOOP BACK. c. Set LOOP BACK AMP as required. d. Set INPUT/OUTPUT switch to match line impedance. e. Set MONITOR VOLUME to mid-range. f. Set OUTPUT LEVEL to value required for circuit to be tested. g. Set line transfer switch to NORMAL RX-TX. h. Set HANDSET switch to HAND SET.
2. Connect a handset to the HANDSET terminals of the 2-wire access unit.	2. Connect the TSG LINE TRANSMIT terminals to an auxiliary 2-wire circuit (eg, A-jack of SD65718 tie line equipment).
3. Connect the CLA terminals on the 2-wire access unit to the CLA or transparent line.	
4. Set 2-wire access unit switches as follows: a. Line transfer switch to REVERSE. b. HANDSET switch to HAND SET.	
5. Answer call from craftsman at customer location.	3. Call central office on first prearranged number.
6. Connect the call to the CLA RX terminal of the 2-wire access unit.	
7. Verify connection by voice coordination.	4. Verify connection by voice coordination.
8. Move 2-wire access unit line transfer switch to NORMAL.	5. Move TSG line transfer switch to REVERSE TX-RX.
	6. Connect the TSG LINE RECEIVE terminals to the circuit to be evaluated.

PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE (CONT)	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION (CONT)
9. Answer call from craftsman at customer location.	
10. Connect the call to the CLA TX terminal of the 2-wire access unit.	7. Call the central office on the second prearranged number.
11. Verify connection by voice coordination.	8. Verify connection by voice.
Note Inform craftsman at customer location to make changes to the TSG only on your command.	
12. Have craftsman at customer location be ready to place the TSG line transfer switch in the NORMAL RX-TX position and the HANDSET switch in the HOLD TSG position.	9. Confirm instructions.
13. Have craftsman execute the TSG switch changes.	10. Execute instructions.
14. Move HANDSET switch on 2-wire access unit to the HOLD CLA position.	Note From this point, instructions from the central office will be received on the speaker in the TSG. If it is necessary to speak to the central office, the TSG HANDSET switch must be moved to the HAND SET position at the same time the central office HANDSET switch is in the HAND SET position, and the TSG line transfer switch must be moved to the opposite position.
15. Set the CLA as follows: a. GN at required level. b. RZ, TZ for correct impedance. c. CLA enabled (EN).	
16. Execute the loop-back (L) test sequence.	
17. Upon completion of the loop-back test, place the 2-wire access unit HANDSET switch in the HAND SET position.	
18. Instruct the craftsman at the customer location to be ready to move the TSG MODE switch to the NORMAL position.	Note Make sure you are ready to move the MODE switch and not the line transfer switch.

PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE (CONT)	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION (CONT)
19. Have craftsman execute the switch change.	11. Execute instruction.
20. Move the 2-wire access unit HANDSET switch to the HOLD CLA position.	12. If the circuit under test has echo suppressors, momentarily depress the ECHO SUPPRESS button.
21. Execute the CLA one-way (0) test.	
22. Upon completion of the one-way test, place the 2-wire access unit HANDSET switch in the HAND SET position.	
23. Instruct craftsman at the customer location to be ready to move the TSG line transfer switch to the REVERSE TX-RX position.	
24. Have craftsman execute switch change.	13. Execute instruction.
25. Move the 2-wire access unit line transfer switch to REVERSE and the HANDSET switch to HOLD CLA.	14. If circuit under test has echo suppressors, momentarily depress the ECHO SUPPRESS button.
26. Execute the CLA normal (N) test sequence.	
27. Upon completion of the normal test, place the 2-wire access HANDSET switch in the HAND SET position.	
Note If harmonic or intermodulation tests are to be made, instructions 28 and 29 may be omitted.	Note If harmonic or intermodulation tests are to be made, instructions 15 and 16 may be omitted.
28. Request craftsman at customer location to move TSG HANDSET switch to HAND SET.	15. Execute instruction.
29. Move 2-wire access unit line transfer switch to NORMAL. Voice coordination now exists between central office and customer location.	16. Voice coordination now exists between central office and customer location.

harmonic distortion tests

PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION
1. Instruct craftsman at customer location to be ready to move TSG MODE switch to HARMONIC.	1. Verify that the TSG line transfer switch is in REVERSE TX-RX and that the HANDSET switch is in HOLD TSG.
2. Verify that 2-wire access unit line transfer switch is in the REVERSE position.	
3. Have craftsman execute the TSG MODE switch change.	2. Execute instruction.
4. Move 2-wire access unit HANDSET switch to HOLD CLA.	3. If the circuit under test has echo suppressors, momentarily depress the ECHO SUPPRESS button.
5. Execute the CLA harmonic (H) test sequence.	
6. Upon completion of the harmonic test, place the 2-wire access unit HANDSET switch in the HAND SET position.	
Note If jitter tests are to be made, instructions 7 and 8 may be omitted.	Note If jitter tests are to be made, instructions 4 and 5 may be omitted.
7. Request craftsman at customer location to move TSG HANDSET switch to HAND SET.	4. Execute instruction.
8. Move 2-wire access unit line transfer switch to NORMAL. Voice coordination now exists between central office and customer location.	5. Voice coordination now exists between central office and customer location.

intermodulation distortion tests

PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION
1. Instruct craftsman at customer location to be ready to move TSG MODE switch to INTERMOD.	1. Verify that the TSG line transfer switch is in the REVERSE TX-RX position and the HANDSET switch is in HOLD TSG.
2. Verify that 2-wire access unit line transfer switch is in the REVERSE position.	
3. Have craftsman execute the TSG MODE switch change.	2. Execute instruction.
4. Move 2-wire access unit HANDSET switch to HOLD CLA.	3. If the circuit under test has echo suppressors, momentarily depress the ECHO SUPPRESS button.
5. Execute the CLA intermodulation distortion (IM) test sequence.	
6. If the intermodulation distortion 2nd and 3rd order products exceed the specified limits, perform the intermodulation noise factor test.	
7. Upon completion of the intermodulation distortion test, place the 2-wire access unit HANDSET switch in the HAND SET position.	
8. Instruct craftsman at customer location to be ready to place the HOLDING TONE in the ON position.	
9. Have craftsman execute the HOLDING TONE sequence.	4. Execute instruction.

PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE (CONT)	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION (CONT)
10. Move the 2-wire access unit HANDSET switch to HOLD CLA.	5. If the circuit under test has echo suppressors, momentarily depress the ECHO SUPPRESS button.
11. Execute the CLA intermodulation noise factor (NF) test sequence.	
12. Upon completion of the test, place the 2-wire access unit HANDSET switch in the HAND SET position.	
Note If jitter tests are to be made, instructions 13 and 14 may be omitted.	Note If jitter tests are to be made, instructions 6 and 7 may be omitted.
13. Request craftsman at customer location to move TSG HANDSET switch to HAND SET position.	6. Execute instruction.
14. Move 2-wire access unit line transfer switch to NORMAL. Voice coordination now exists between central office and customer location.	7. Voice coordination now exists between central office and customer location.

phase jitter tests

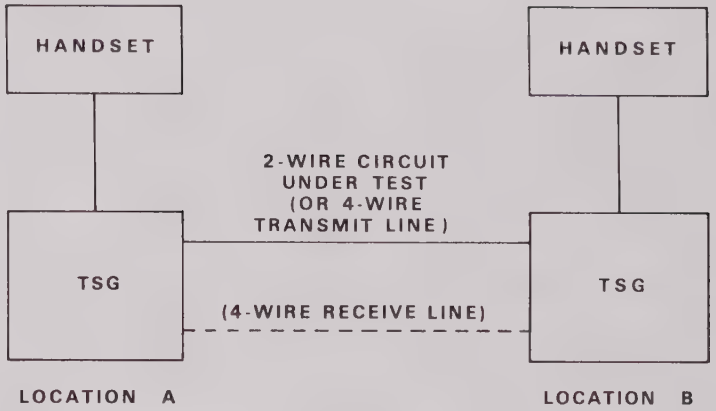
PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION
1. Instruct craftsman at customer location to be ready to move TSG MODE switch to JITTER position.	1. Verify that the TSG line transfer switch is in REVERSE TX-RX and that the HANDSET switch is in HOLD TSG.
2. Verify that 2-wire access unit line transfer switch is in the REVERSE position.	
3. Have craftsman execute the TSG MODE switch change.	2. Execute instruction.
4. Move 2-wire access unit HANDSET switch to HOLD CLA.	3. If the circuit under test has echo suppressors, momentarily depress the ECHO SUPPRESS button.
5. Execute the CLA jitter (J) test sequence.	
6. Upon completion of the jitter test, place the 2-wire access unit HANDSET switch in the HAND SET position.	
Note If noise tests are to be made, instructions 7 and 8 may be omitted.	Note If noise tests are to be made, instructions 4 and 5 may be omitted.
7. Request craftsman at customer location to move TSG HANDSET switch to HAND SET.	4. Execute instruction.
8. Move 2-wire access unit line transfer switch to NORMAL. Voice coordination now exists between central office and customer location.	5. Voice coordination now exists between central office and customer location.

PROCEDURES FOR CRAFTSMAN AT CENTRAL OFFICE	PROCEDURES FOR CRAFTSMAN AT CUSTOMER LOCATION
1. Instruct craftsman at customer location to be ready to move TSG MODE switch to NOISE, and set HOLDING TONE to the ON position, if required.	1. Verify that the TSG line transfer switch is in REVERSE TX-RX and that the HANDSET switch is in HOLD TSG.
2. Verify that 2-wire access unit line transfer switch is in the REVERSE position.	
3. Have craftsman execute the TSG mode switch change.	2. Execute instruction.
4. Move 2-wire access unit HANDSET switch to HOLD CLA.	3. If the circuit under test has echo suppressors, momentarily depress the ECHO SUPPRESS button.
5. Execute the CLA noise test sequence (N) without holding tone and (W) with holding tone.	
6. Upon completion of the noise test, place the 2-wire access unit HANDSET switch in the HAND SET position.	
7. Request craftsman at customer location to be ready to move the TSG HANDSET switch to HAND SET and the TSG line transfer switch to NORMAL RX-TX.	
8. Have craftsman execute instruction.	4. Execute instruction.
9. Voice coordination now exists between central office and customer location.	5. Voice coordination now exists between central office and customer location.

Note

If further circuits are to be tested, the connected circuit in customer location must be dropped and the new circuit connected in the same manner.

TSG-TSG tests



The TSG-TSG combination measures:

- Line loss
- Frequency response
- Noise
- Impulse noise

Two-Wire Circuits

Test signals are first transmitted from the TSG at A over the 2-wire circuit to the TSG at B, and measurements of loss, response, and noise are made at B. The transfer switches are then reversed, B transmits to A, and measurements are made at A.

Four-Wire Circuits

Connections are made to LINE TRANSMIT and LINE RECEIVE terminals. The line transfer switch must remain in NORMAL position.

summary checklist

TSG / LNI	VFO (REMOTE)	LOOP BACK	NORMAL	(HARMONIC) INTERMOD, JITTER, NOISE
LEVEL BRIDGE	TSG to xmt Rcv bridged with 10 kΩ Meter reads volts only Volume (rcv)	Rcv to xmt No bridging No level measurement Volume	TSG to xmt Rcv bridged with 10 kΩ Volume (rcv)	Same as NORMAL
LEVEL TERM	TSG to xmt Terminated level in V rms or dB mW (rcv) Volume (rcv)	Rcv to xmt Terminated level in V rms or dB mW (rcv)	TSG to xmt Terminated level in V rms or dB mW (rcv) Volume (rcv)	Same as NORMAL
NOISE TERM	TSG to xmt Noise level in dB rn, dB mW, or V rms Weighting Volume (rcv)	Rcv to xmt Noise level in dB rn, dB mW, or V rms Weighting Volume	TSG to xmt Noise level in dB rn, dB mW, or V rms Weighting Volume (rcv)	Same as NORMAL
IMPULSE TERM	TSG to xmt No level measurement Threshold and test period Weighting Volume (rcv)	Rcv to xmt No level measurement Threshold and test period Weighting Volume	TSG to xmt No level measurement Threshold and test period Weighting Volume (rcv)	Same as NORMAL

Note

1. Abbreviations: TSG - test signal generator; xmt - LINE TRANSMIT; rcv - LINE RECEIVE; LNI - level/noise/impulse.
2. Impedance: Input impedance is fixed at 10 kΩ with LNI in LEVEL BRIDGE and TSG in NORMAL, HARMONIC, JITTER, or NOISE.
3. In LOOP BACK, amplifier gain is selectable at 0, 8, or 16 dB.
4.

MODEL	HOLDING TONE NOTCH FREQ (Hz)	ECHO SUPPRESSOR FREQ (Hz)
7303A-1C	2797	2127
7303A-4D	2805	2125
7303A-9C	2805	2125
7303A-5C	1005 (2805, note 5)	2125
7303A-6C	1005 (2805, note 5)	2125
7303A-10C	1005 (2805, note 5)	2125

5. A 2805-Hz holding tone can be selected in -5C, -6C, and -10C models (MODE switch set to NORMAL, and HOLDING TONE set to ON). However, there is no 2805-Hz notch.

Notes:

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